US 20150372372A1

(19) **United States**

(12) **Patent Application Publication**

LEE et al.

(10) **Pub. No.: US 2015/0372372 A1**

(43) **Pub. Date: Dec. 24, 2015**

(54) **ELECTRONIC DEVICE WITH ANTENNA HAVING RING-TYPE STRUCTURE**

(71) Applicant: **Samsung Electronics Co., Ltd.**, Gyeonggi-do (KR)

(72) Inventors: **Woo-Sup LEE**, Gyeonggi-do (KR); **Gyu-Sub KIM**, Seoul (KR); **Yeon-Woo KIM**, Gyeonggi-do (KR); **Jung-Sik PARK**, Gyeonggi-do (KR)

(21) Appl. No.: **14/737,825**

(22) Filed: **Jun. 12, 2015**

(30) **Foreign Application Priority Data**

Jun. 23, 2014 (KR) 10-2014-0076496

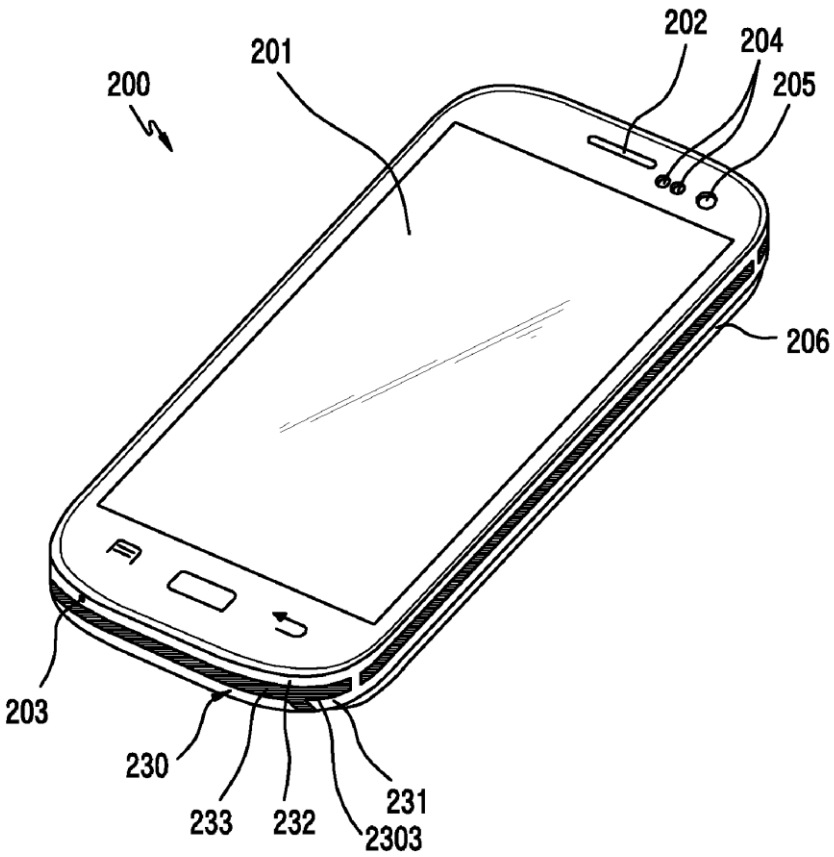
Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

Various exemplary embodiments of the present disclosure may provide an electronic device including an antenna with a ring-type structure. The electronic device includes a metal bracket and the antenna. The antenna includes a first metal ring surrounding the metal bracket, where the first metal ring has at least two sections separated by at least one gap. At least one section may operate as a radiator through radio frequency (RF) feeding at least at one portion thereof. A second metal ring may be electrically connected, at least at one point thereof, to a ground of the electronic device or to the first metal ring. At least one section of the first metal ring may operate as a monopole antenna, as a PIFA antenna, or as a loop antenna, via suitable feeding.



US 20150372383A1

(19) **United States**

(12) **Patent Application Publication**

YOSHIDA

(10) **Pub. No.: US 2015/0372383 A1**

(43) **Pub. Date: Dec. 24, 2015**

(54) **DUAL BAND ANTENNA DEVICE**

(71) Applicant: **NEC CORPORATION**, Minato-ku, Tokyo (JP)

(72) Inventor: **Takahide YOSHIDA**, Tokyo (JP)

(73) Assignee: **NEC CORPORATION**, Tokyo (JP)

(21) Appl. No.: **14/763,258**

(22) PCT Filed: **Feb. 14, 2014**

(86) PCT No.: **PCT/JP2014/000761**

§ 371 (c)(1),
(2) Date: **Jul. 24, 2015**

(30) **Foreign Application Priority Data**

Feb. 18, 2013 (JP) 2013-028747

Publication Classification

(51) **Int. Cl.**

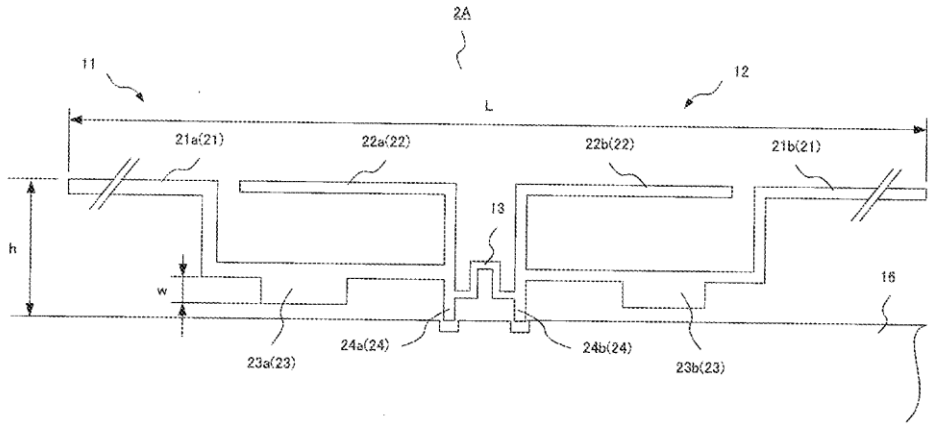
H01Q 5/335 (2006.01)
H01Q 21/00 (2006.01)
H01Q 5/10 (2006.01)
H01Q 1/50 (2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 5/335*** (2015.01); ***H01Q 1/50*** (2013.01); ***H01Q 21/0006*** (2013.01); ***H01Q 5/10*** (2015.01)

(57) **ABSTRACT**

A dual band antenna device includes a first antenna unit which includes a first long element, a first short element whose resonant frequency is different from the resonant frequency of the first long element, a first frequency adjustment element provided in the first long element to adjust the resonant frequency, and a first power feeding port that is a power feeding end; a second antenna unit which includes a second long element, a second short element whose resonant frequency is different from the resonant frequency of the second long element, a second frequency adjustment element provided in the second long element to adjust the resonant frequency, and a second power feeding port that is a power feeding end; and a coupling element which connects the first antenna unit and the second antenna unit while adjusting a mutual impedance between the first antenna unit and a second antenna unit.



US 20150372384A1

(19) **United States**

(12) **Patent Application Publication**

LIU et al.

(10) **Pub. No.: US 2015/0372384 A1**

(43) **Pub. Date: Dec. 24, 2015**

(54) **SWITCHABLE PI SHAPE ANTENNA**

(71) Applicant: **Futurewei Technologies, Inc.**, Plano, TX (US)

(72) Inventors: **Hongwei LIU**, San Diego, CA (US); **Ning MA**, San Diego, CA (US)

(73) Assignee: **FUTUREWEI TECHNOLOGIES, INC.**, Plano, TX (US)

(21) Appl. No.: **14/842,665**

(22) Filed: **Sep. 1, 2015**

Related U.S. Application Data

(63) Continuation of application No. 14/274,474, filed on May 9, 2014, now Pat. No. 9,184,494.

Publication Classification

(51) **Int. Cl.**

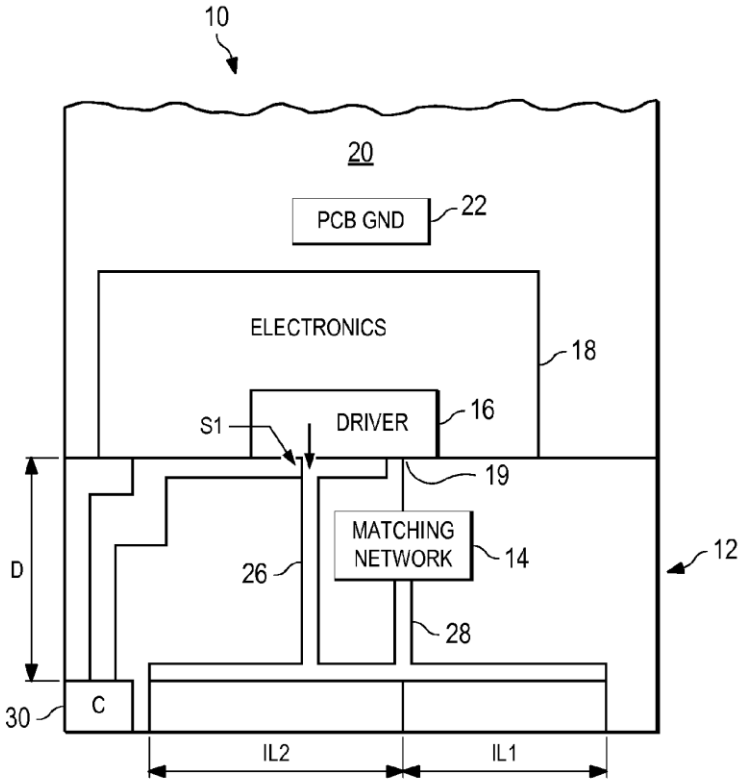
H01Q 5/335	(2006.01)
H04W 72/04	(2006.01)
H01Q 1/38	(2006.01)
H04L 25/02	(2006.01)
H01Q 1/50	(2006.01)
H01Q 9/04	(2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 5/335*** (2015.01); ***H01Q 1/50*** (2013.01); ***H01Q 9/04*** (2013.01); ***H01Q 1/38*** (2013.01); ***H04L 25/0278*** (2013.01); ***H04W 72/0453*** (2013.01)

(57) **ABSTRACT**

A mobile device including a housing having a distal end, and electronics disposed in the housing configured to operate the mobile device. A connector is coupled to the electronics, and a Pi-shaped antenna has a coupling coupled to the connector to create a resonance using the connector. The Pi-shaped antenna and the connector are configured to wirelessly send and receive the wireless signals. An impedance matching network matches the impedance of the electronics to the Pi-shaped antenna. In some embodiments, the impedance matching network is switchable by the electronics and is configured to match an impedance of the electronics to the Pi-shaped antenna in at least two states, over multiple RF bands.



US 20150380818A1

(19) **United States**

(12) **Patent Application Publication**

Svendsen et al.

(10) **Pub. No.: US 2015/0380818 A1**

(43) **Pub. Date: Dec. 31, 2015**

(54) **ANTENNA CONFIGURATION WITH A COUPLER ELEMENT FOR WIRELESS COMMUNICATION**

(71) Applicant: **Intel IP Corporation**, Santa Clara, CA (US)

(72) Inventors: **Simon Svendsen**, Aalborg (DK); **Ole Jagielski**, Frederikshavn (DK); **Boyan Yanakiev**, Aalborg (DK); **Finn Hausager**, Aabybro (DK)

(21) Appl. No.: **14/318,754**

(22) Filed: **Jun. 30, 2014**

Publication Classification

(51) **Int. Cl.**

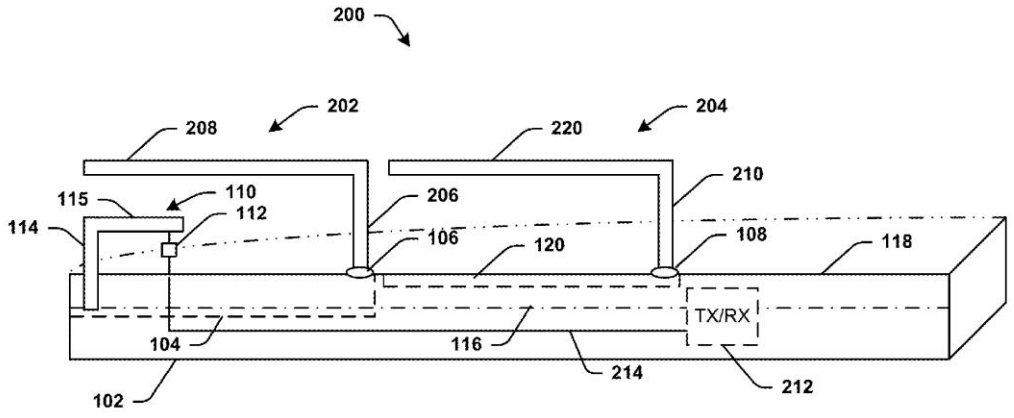
H01Q 5/10	(2006.01)
H01Q 5/307	(2006.01)
H01Q 5/20	(2006.01)

(52) **U.S. Cl.**

CPC . ***H01Q 5/10*** (2015.01); ***H01Q 5/20*** (2015.01); ***H01Q 5/307*** (2015.01)

(57) **ABSTRACT**

A first antenna element is indirectly coupled to communication signals via a coupler that is located within a same volume of a body. A second antenna element is proximate to and adjacent the first antenna element. The first antenna element is configured to operate in a first frequency range and the second antenna element is configured to operate within a subset of the first frequency range concurrent with or simultaneously to the first antenna element. The coupler can operate to couple multiple antenna elements operating at different frequencies within the same volume of the body.



US 20150380819A1

(19) **United States**

(12) **Patent Application Publication**

Komulainen et al.

(10) **Pub. No.: US 2015/0380819 A1**

(43) **Pub. Date: Dec. 31, 2015**

(54) **ANTENNA ARRANGEMENT**

(71) Applicant: **Nokia Technologies Oy**, Espoo (FI)

(72) Inventors: **Mikko S. Komulainen**, Oulu (FI); **Sami Hienonen**, Oulu (FI); **Tommi Lepisto**, Kempele (FI)

(73) Assignee: **Nokia Technologies Oy**

(21) Appl. No.: **14/714,528**

(22) Filed: **May 18, 2015**

Related U.S. Application Data

(63) Continuation of application No. 13/630,018, filed on Sep. 28, 2012, now Pat. No. 9,035,830.

Publication Classification

(51) **Int. Cl.**

H01Q 5/20 (2006.01)

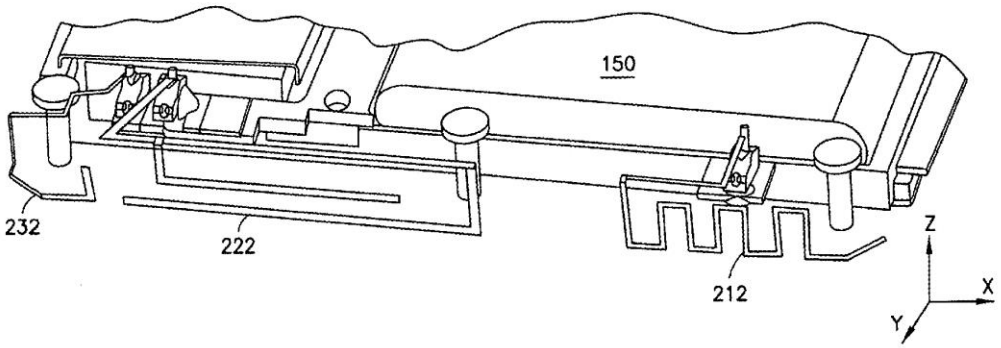
H01Q 9/04 (2006.01)

(52) **U.S. Cl.**

CPC ... ***H01Q 5/20*** (2015.01); ***H01Q 9/04*** (2013.01)

(57) **ABSTRACT**

An apparatus for antenna arrangement isolation is described. The apparatus includes a first antenna element (for example, a CMMB TV antenna) having a first radiator component and a second antenna element (for example, a cellular antenna) having a second radiator component. A first portion of the first radiator component is adjacent to a second portion of the second radiator component. The second radiator component is configured with at least one operational frequency range. The first portion of the first radiator corresponds to at least one minimum electric field region of at least one resonant frequency of the first radiator. The at least one resonant frequency of the first radiator overlaps with the at least one operational frequency range. Methods, Apparatus and Computer readable media for providing the antenna arrangement are also described.



US 20150380820A1

(19) **United States**

(12) **Patent Application Publication**

WU et al.

(10) **Pub. No.: US 2015/0380820 A1**

(43) **Pub. Date: Dec. 31, 2015**

(54) **MOBILE DEVICE AND MANUFACTURING METHOD THEREOF**

(71) Applicant: **HTC Corporation**, Taoyuan City (TW)

(72) Inventors: **Chun-Yih WU**, Taoyuan City (TW); **Yen-Liang KUO**, Taoyuan City (TW); **Chien-Chih CHEN**, Taoyuan City (TW)

(21) Appl. No.: **14/316,050**

(22) Filed: **Jun. 26, 2014**

Publication Classification

(51) **Int. Cl.**

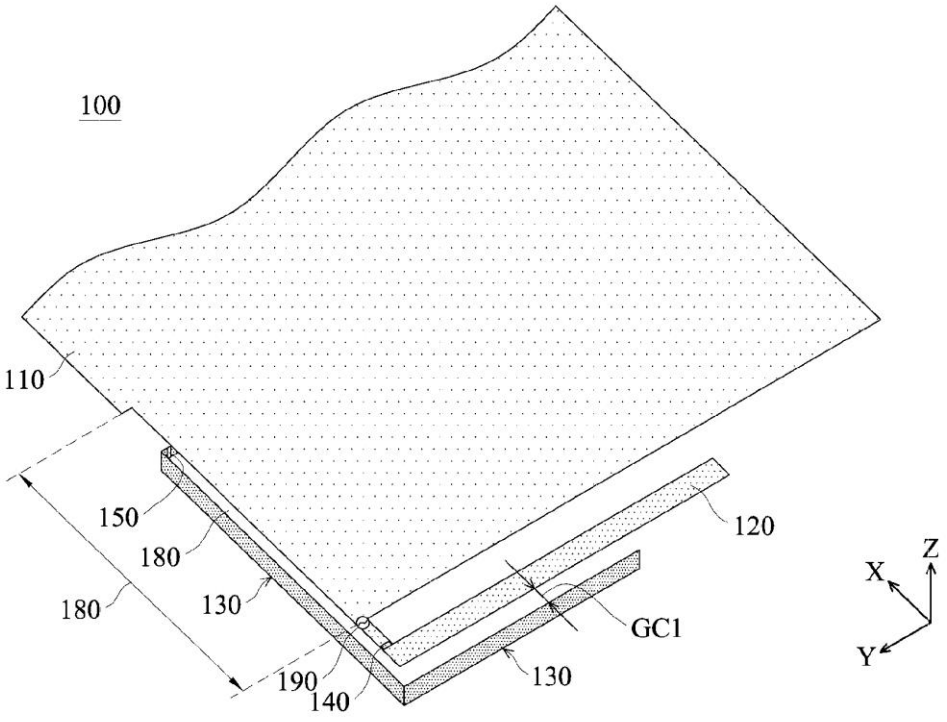
H01Q 5/378	(2006.01)
H01Q 1/44	(2006.01)
H01Q 1/24	(2006.01)
H01Q 5/314	(2006.01)
H01Q 1/38	(2006.01)
H01Q 9/30	(2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 5/378*** (2015.01); ***H01Q 1/38*** (2013.01); ***H01Q 9/30*** (2013.01); ***H01Q 1/243*** (2013.01); ***H01Q 5/314*** (2015.01); ***H01Q 1/44*** (2013.01)

(57) **ABSTRACT**

A mobile device includes a ground plane, a first radiation branch, and a second radiation branch. The second radiation branch is coupled to the ground plane, and is disposed adjacent to the first radiation branch. An antenna structure is formed by the first radiation branch and the second radiation branch. The first radiation branch is fed from a signal source. The second radiation branch is excited by the first radiation branch through coupling therebetween.



US 20150380825A1

(19) **United States**

(12) **Patent Application Publication**

RYU et al.

(10) **Pub. No.: US 2015/0380825 A1**

(43) **Pub. Date: Dec. 31, 2015**

(54) **ANTENNA MODULE AND MOBILE TERMINAL INCLUDING SAME**

(71) Applicant: **LG ELECTRONICS INC.**, Yeoui-daero, Yeongdeungpo-gu Seoul (KR)

(72) Inventors: **Seungwoo RYU**, Seoul (KR); **Hyengcheul CHOI**, Seoul (KR); **Chisang YOU**, Seoul (KR); **Soyeon LEE**, Seoul (KR); **Kyoungsun HWANG**, Seoul (KR); **Songyi LEE**, Seoul (KR); **Byungeun JEON**, Seoul (KR)

(73) Assignee: **LG ELECTRONICS INC.**, Yeongdeungpo-gu, Seoul (KR)

(21) Appl. No.: **14/765,262**

(22) PCT Filed: **Oct. 24, 2013**

(86) PCT No.: **PCT/KR2013/009501**

§ 371 (c)(1),
(2) Date: **Jul. 31, 2015**

(30) **Foreign Application Priority Data**

Mar. 15, 2013 (KR) 10-2013-0028206
Apr. 15, 2013 (KR) 10-2013-0041137

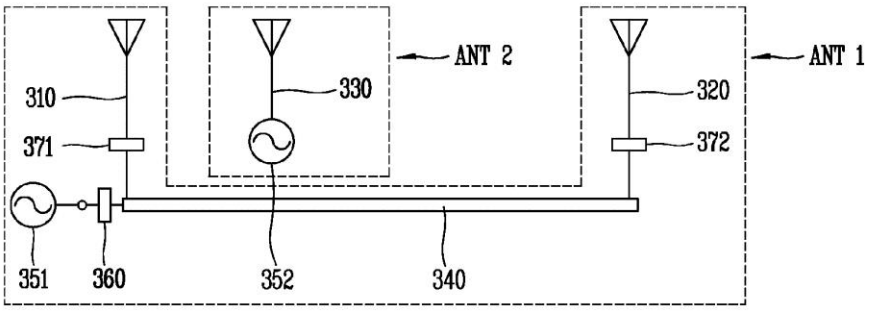
Publication Classification

(51) **Int. Cl.**
H01Q 9/16 (2006.01)
H01Q 1/50 (2006.01)
H01Q 5/40 (2006.01)

(52) **U.S. Cl.**
CPC . ***H01Q 9/16*** (2013.01); ***H01Q 5/40*** (2015.01); ***H01Q 1/50*** (2013.01)

(57) **ABSTRACT**

Disclosed are an antenna module and a mobile terminal having the same. The antenna module includes: a first member and a second member configured to operate as radiators of an antenna for transmitting/receiving radio signals; a first feeding unit configured to feed the first and second members; and a transmission line configured to connect the second member to the first feeding unit so that, when the first member forms a magnetic field in a near field, the second member forms an electric field.



US 20160006109A1

(19) **United States**

(12) **Patent Application Publication**

Apaydin et al.

(10) **Pub. No.: US 2016/0006109 A1**

(43) **Pub. Date: Jan. 7, 2016**

(54) **SLOT ANTENNA INTEGRATED INTO A RESONANT CAVITY OF AN ELECTRONIC DEVICE CASE**

(71) Applicant: **Microsoft Corporation**, Redmond, WA (US)

(72) Inventors: **Nil Apaydin**, Redmond, WA (US); **Paul O'Brien**, Sammamish, WA (US); **Javier R. De Luis**, Kirkland, WA (US); **Ben Shewan**, Redmond, WA (US); **Alireza Mahanfar**, Bellevue, WA (US); **Sidharath Jain**, Kirkland, WA (US)

(21) Appl. No.: **14/517,666**

(22) Filed: **Oct. 17, 2014**

Related U.S. Application Data

(60) Provisional application No. 62/019,692, filed on Jul. 1, 2014.

Publication Classification

(51) **Int. Cl.**

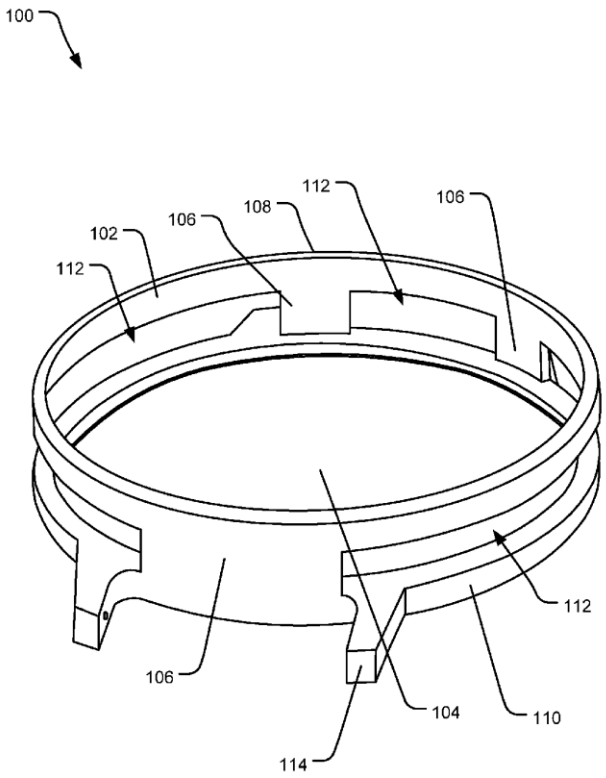
H01Q 1/27	(2006.01)
H01Q 1/48	(2006.01)
H01Q 13/10	(2006.01)
G06F 1/16	(2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 1/273*** (2013.01); ***G06F 1/163*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 13/10*** (2013.01)

(57) **ABSTRACT**

An electronic device case includes a conductive cap section and a conductive bezel section forming a perimeter outside the conductive cap section and separated from the conductive cap section by a bezel gap. A conductive ground plane section forms a perimeter and is positioned opposite the conductive cap section and the conductive bezel section. The conductive ground plane section is separated from the conductive bezel section by a perimeter gap. One or more components reside between the conductive cap section and the conductive ground plane section forming a resonant cavity including a ground plane resonant cavity portion between the one or more components and the conductive ground plane section and a substantially annular resonant cavity portion between the one or more components and the perimeters of the conductive bezel section and the conductive ground plane section.



US 20160006111A1

(19) **United States**

(12) **Patent Application Publication**

Miskovský et al.

(10) **Pub. No.: US 2016/0006111 A1**

(43) **Pub. Date: Jan. 7, 2016**

(54) **ANTENNA DEVICE AND WEARABLE DEVICE COMPRISING SUCH ANTENNA DEVICE**

(71) Applicant: **Sunway Communication (Beijing) Co., Ltd.**, Beijing (CN)

(72) Inventors: **Pavel Miskovský**, Enskede (SE); **Axel von Arbin**, Täby (SE)

(21) Appl. No.: **14/788,899**

(22) Filed: **Jul. 1, 2015**

(30) **Foreign Application Priority Data**

Jul. 2, 2014 (CN) 201410318668.0
Jul. 2, 2014 (CN) 201420370875.6

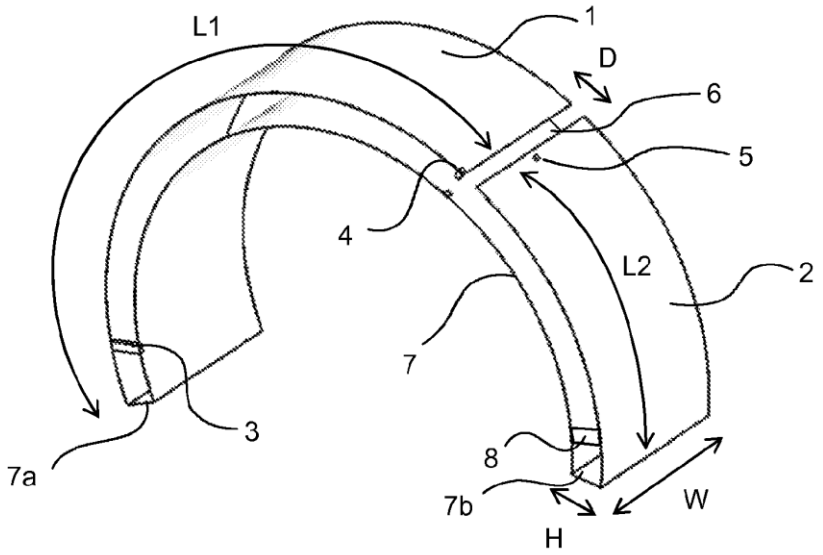
Publication Classification

(51) **Int. Cl.**
H01Q 1/27 (2006.01)
H01Q 1/36 (2006.01)
H01Q 1/48 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 1/273*** (2013.01); ***H01Q 1/48*** (2013.01); ***H01Q 1/36*** (2013.01)

(57) **ABSTRACT**

An antenna device for radio communications in a wearable device comprises a ground plate having an arc shape, a first antenna plate extending essentially parallel to the ground plate and connected thereto at a first end portion of the ground plate, the first antenna plate having a first feed terminal, and a second antenna plate extending essentially parallel to a the ground plate and connected thereto at a second end portion of the ground plate opposite to the first end portion of the ground plate, the second antenna plate having a second feed terminal. A gap is provided between the first antenna plate and the second antenna plate.



US 20160006125A1

(19) **United States**

(12) **Patent Application Publication**

LAI et al.

(10) **Pub. No.: US 2016/0006125 A1**

(43) **Pub. Date: Jan. 7, 2016**

(54) **CHIP-TYPE ANTENNA DEVICE AND CHIP STRUCTURE**

(71) Applicant: **AUDEN TECHNO CORP.**, TAOYUAN COUNTY (TW)

(72) Inventors: **SHIH-CHI LAI**, MIAOLI COUNTY (TW); **TZU-HSIANG CHIEN**, TAOYUAN COUNTY (TW); **CHENG-MIN YANG**, KAOHSIUNG CITY (TW)

(21) Appl. No.: **14/321,898**

(22) Filed: **Jul. 2, 2014**

Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

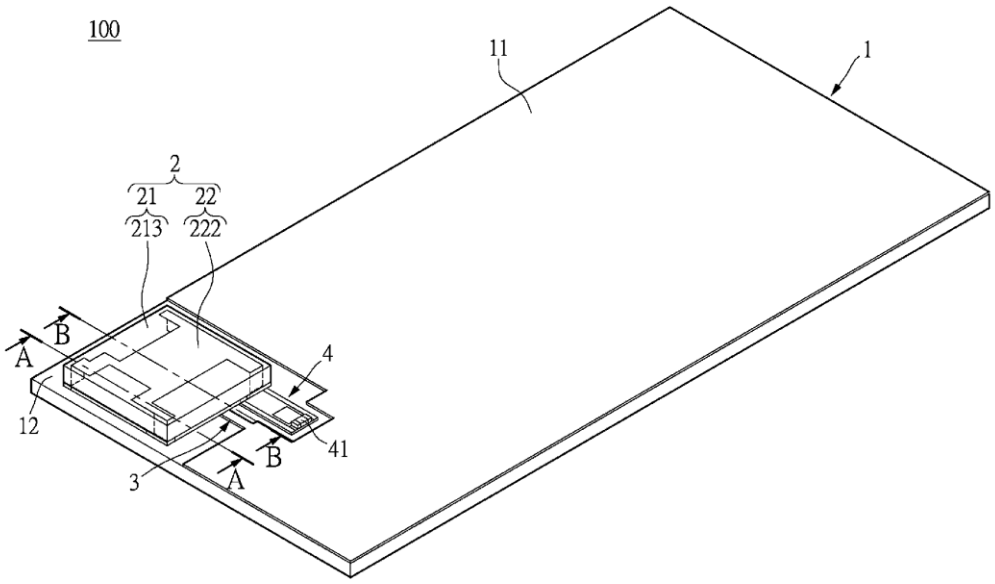
H01Q 1/48 (2006.01)

(52) **U.S. Cl.**

CPC . ***H01Q 9/045*** (2013.01); ***H01Q 1/48*** (2013.01)

(57) **ABSTRACT**

A chip structure for mounting on a clearance area of a printed circuit board includes a packaged chip and a monopole coupling antenna. The packaged chip has an insulating body, an electronic component embedded in the insulating body, and a plurality of grounding pads electrically connected to the electronic component. The monopole coupling antenna has a grounding radiating metal and a monopole radiating metal. The packaged chip is electrically connected to the grounding radiating metal by the grounding pads. The monopole radiating metal is disposed on the insulating body and spaced apart from the electronic component and the grounding radiating metal. The monopole radiating metal is configured to couple the grounding radiating metal and the electronic component by using a feeding circuit to connect the packaged chip and the monopole radiating metal and using a grounding circuit to connect the grounding radiating metal and the printed circuit board.



US 20160006126A1

(19) **United States**

(12) **Patent Application Publication**

Suh

(10) **Pub. No.: US 2016/0006126 A1**

(43) **Pub. Date: Jan. 7, 2016**

(54) **ANTENNA AND MOBILE DEVICE THEREWITH**

(71) Applicant: **Samsung Electronics Co., Ltd.**, Gyeonggi-do (KR)

(72) Inventor: **Young-Hoon Suh**, Gyeonggi-do (KR)

(21) Appl. No.: **14/792,323**

(22) Filed: **Jul. 6, 2015**

(30) **Foreign Application Priority Data**

Jul. 4, 2014 (KR) 10-2014-0083862

Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

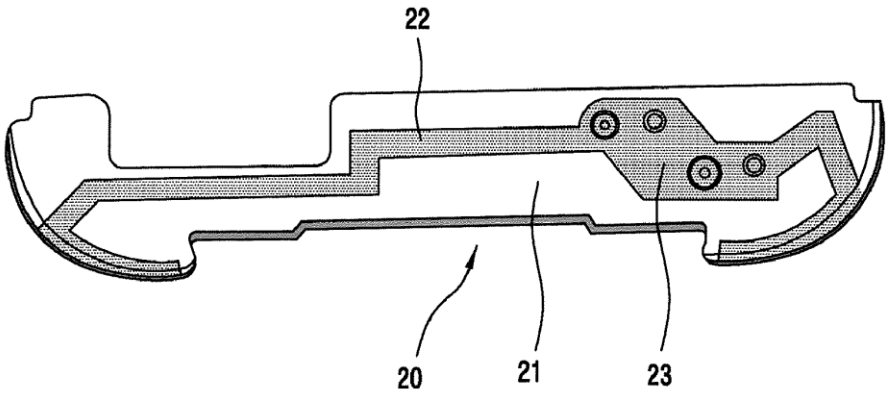
H01Q 1/24 (2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 9/0407*** (2013.01); ***H01Q 1/243*** (2013.01)

(57) **ABSTRACT**

An antenna of a mobile device is provided. The antenna includes two antennas that are disposed to be stepped from each other, thereby preventing degradation of an OTA characteristic and reducing an SAR. The antenna includes first and second surfaces stepped from each other on the top surface of an antenna carrier, and a low-band antenna emitter disposed on the first surface and a high-band antenna emitter disposed on the recessed second surface.



US 20160013543A1

(19) **United States**

(12) **Patent Application Publication**

NGUYEN

(10) **Pub. No.: US 2016/0013543 A1**

(43) **Pub. Date: Jan. 14, 2016**

(54) **ANTENNA APPARATUS AND METHOD OF MAKING SAME**

(75) Inventor: **Anthony NGUYEN**, San Diego, CA (US)

(73) Assignee: **Nokia Technologies Oy**, Espoo (FI)

(21) Appl. No.: **14/422,528**

(22) PCT Filed: **Aug. 20, 2012**

(86) PCT No.: **PCT/IB2012/054213**

§ 371 (c)(1),
(2), (4) Date: **Jun. 10, 2015**

Publication Classification

(51) **Int. Cl.**

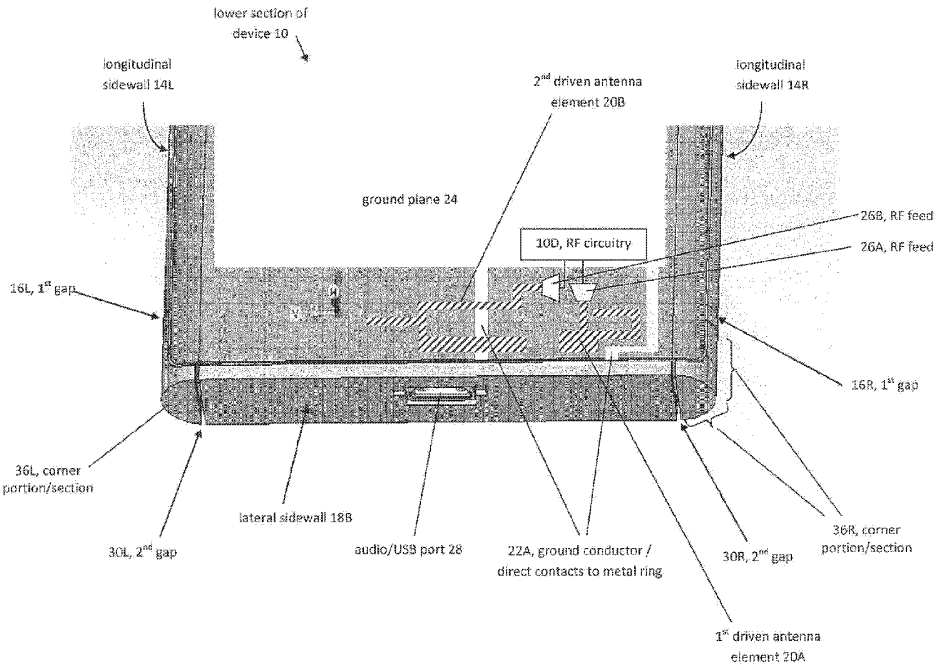
H01Q 1/24	(2006.01)
H01Q 21/00	(2006.01)
H01Q 21/30	(2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 1/243*** (2013.01); ***H01Q 21/30*** (2013.01); ***H01Q 21/0087*** (2013.01)

(57) **ABSTRACT**

A housing defines a face bounded by opposed longitudinal and opposed lateral sidewalls. At least one conductive portion of at least one longitudinal sidewall is electrically isolated from at least one conductive portion of at least one of the lateral sidewalls by at least one corner section that is non-conductive or electrically floating. At least one antenna element internal to the housing is electrically coupled to radio frequency circuitry; and a conductor configured to electrically couple the at least one conductive portion of the at least one lateral sidewall between the opposed longitudinal portions to a ground plane. In a specific embodiment, there are two opposed corner sections each defined by first and second gaps, and the lateral conductive portion between the corner sections parasitically couples to the antenna element when transmitting or receiving. The corner sections may each have a corner conductive portion which are isolated by the gaps.



US 20160013544A1

(19) **United States**

(12) **Patent Application Publication**

Lyons et al.

(10) **Pub. No.: US 2016/0013544 A1**

(43) **Pub. Date: Jan. 14, 2016**

(54) **WATCH WITH BEZEL ANTENNA CONFIGURATION**

(71) Applicant: **Garmin Switzerland GmbH**, Schaffhausen (CH)

(72) Inventors: **Justin R. Lyons**, Olathe, KS (US); **Todd P. Register**, Olathe, KS (US); **Toby C. Wilcher**, Prairie Village, KS (US); **Jesse R. Simpson**, Overland Park, KS (US); **David L. Dorris**, Olathe, KS (US)

(21) Appl. No.: **14/863,110**

(22) Filed: **Sep. 23, 2015**

Related U.S. Application Data

(63) Continuation of application No. 14/174,330, filed on Feb. 6, 2014, now Pat. No. 9,172,148.

Publication Classification

(51) **Int. Cl.**

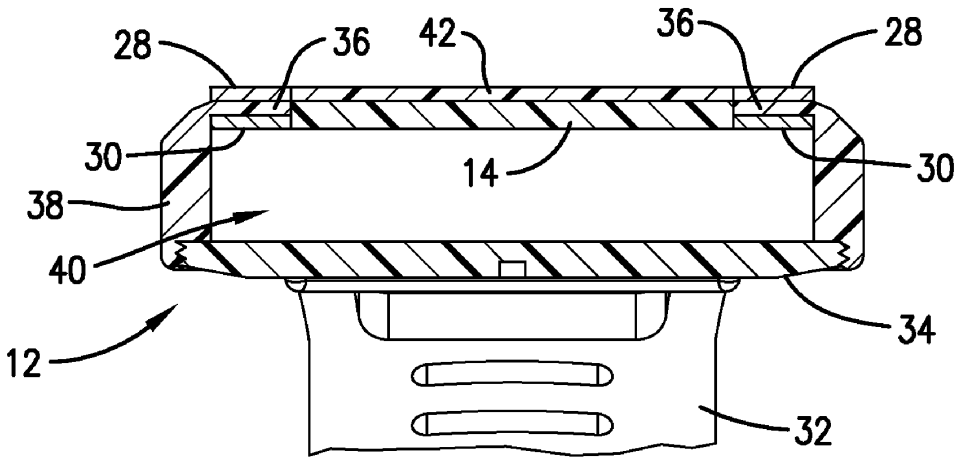
H01Q 1/27	(2006.01)
G04G 17/02	(2006.01)
G01S 19/24	(2006.01)
G04G 21/04	(2006.01)
H01Q 1/24	(2006.01)
G01S 19/14	(2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 1/273*** (2013.01); ***H01Q 1/241*** (2013.01); ***G01S 19/14*** (2013.01); ***G01S 19/24*** (2013.01); ***G04G 21/04*** (2013.01); ***G04G 17/02*** (2013.01)

(57) **ABSTRACT**

A wrist-worn electronic device comprises a housing, a display, a location determining element, a first antenna, and second antenna. The housing includes a lower surface configured to contact a wearer's wrist, an opposing upper surface, and an internal cavity. The display is visible from the upper surface of the housing. The location determining element is configured to process a location signal to determine a current geolocation of the electronic device. The first antenna is positioned on the upper surface of the housing adjacent a perimeter of the display and electrically connected with the second antenna positioned at least partially within the internal cavity. The first antenna and second antenna function in cooperation to receive the location signal from a satellite-based positioning system and communicate the location signal to the location determining element.



US 20160013546A1

(19) **United States**

(12) **Patent Application Publication**

TOYAO et al.

(10) **Pub. No.: US 2016/0013546 A1**

(43) **Pub. Date: Jan. 14, 2016**

(54) **ANTENNA, PRINTED CIRCUIT BOARD, AND WIRELESS COMMUNICATION DEVICE**

(71) Applicants: **NEC CORPORATION**, Minato-ku, Tokyo (JP); **NEC PLATFORMS, LTD.**, Kawasaki-shi, Kanagawa (JP)

(72) Inventors: **Hiroshi TOYAO**, Tokyo (JP); **Jun UCHIDA**, Kanagawa (JP)

(73) Assignees: **NEC PLATFORMS, LTD.**, Kawasaki-shi, Kanagawa (JP); **NEC CORPORATION**, Tokyo (JP)

(21) Appl. No.: **14/770,132**

(22) PCT Filed: **Dec. 6, 2013**

(86) PCT No.: **PCT/JP2013/082821**

§ 371 (c)(1),
(2) Date: **Aug. 25, 2015**

(30) **Foreign Application Priority Data**

Feb. 26, 2013 (JP) 2013-035539

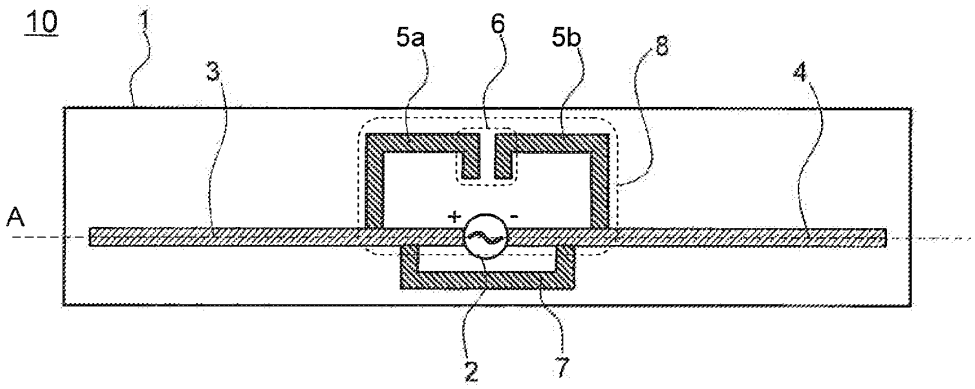
Publication Classification

(51) **Int. Cl.**
H01Q 1/36 (2006.01)
H04B 1/40 (2006.01)

(52) **U.S. Cl.**
CPC ... ***H01Q 1/36*** (2013.01); ***H04B 1/40*** (2013.01)

(57) **ABSTRACT**

An antenna (**10**) includes: a first radiant element (**3**) and a second radiant element (**4**), which are connected to an antenna feeding point (**2**); a first branch part (**5***a*), one end of which is connected to the first radiant element (**3**) at a position not corresponding to an end portion of the first radiant element (**3**); a second branch part (**5***b*), one end of which is connected to the second radiant element (**4**) at a position not corresponding to an end portion of the second radiant element (**4**); and a connection element (**7**), which connects part of the first radiant element (**3**) and part of the second radiant element (**4**). A different end of the first branch part (**5***a*) and a different end of the second branch part (**5***b*) face each other and form a capacitor part. The capacitor part is positioned outside the area surrounded by the connection element (**7**), the first radiant element (**3**), and the second radiant element (**4**). Part of the first radiant element (**3**), part of the second radiant element (**4**), the first branch part (**5***a*), the second branch part (**5***b*), and the capacitor part form a split ring resonator (**8**).



US 20160013558A1

(19) **United States**

(12) **Patent Application Publication**

HWANG et al.

(10) **Pub. No.: US 2016/0013558 A1**

(43) **Pub. Date: Jan. 14, 2016**

(54) **MULTILAYER PATCH ANTENNA**

(71) Applicant: **AMOTECH CO., LTD.**, Incheon (KR)

(72) Inventors: **Chul HWANG**, Incheon (KR); **In-Jo JEONG**, Incheon (KR); **Sang-O KIM**, Incheon (KR); **Ki-Hwan YOU**, Incheon (KR); **Tae-Jae CHO**, Incheon (KR); **Gil-Yup SONG**, Incheon (KR); **Kyou-Yub LEE**, Seoul (KR); **Hyeong-Jin YOON**, Incheon (KR)

(21) Appl. No.: **14/328,141**

(22) Filed: **Jul. 10, 2014**

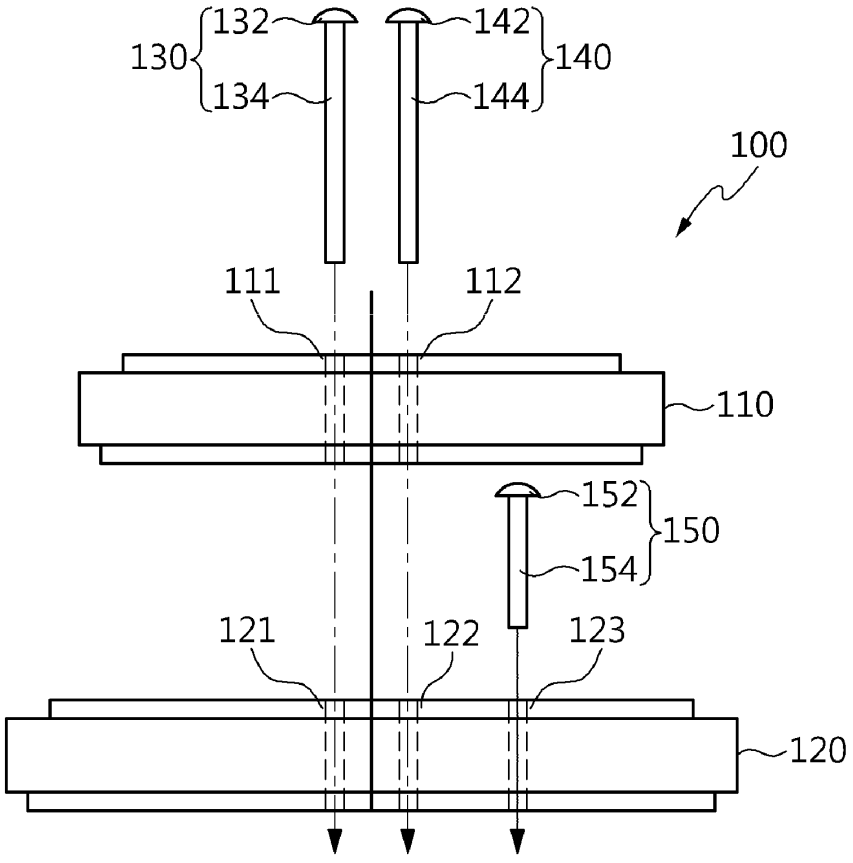
Publication Classification

(51) **Int. Cl.**
H01Q 9/04 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 9/0414*** (2013.01); ***H01Q 9/045*** (2013.01)

(57) **ABSTRACT**

Disclosed is a multilayer-type patch antenna including: an upper patch antenna portion having a first through hole and a second through hole which are at a predetermined angle; a lower patch antenna portion having a third through hole and a fourth through hole which are at a predetermined angle, and a fifth through hole which is spaced from the third through hole and the fourth through hole; a first feeding pin which passes through the first through hole and the third through hole and protrudes from a lower end of the lower patch antenna portion; a second feeding pin which passes through the second through hole and the fourth through hole and protrudes from the lower end of the lower patch antenna portion; and a third feeding pin which passes through the fifth through hole and protrudes from the lower end of the lower patch antenna portion.



US 20160013560A1

(19) **United States**

(12) **Patent Application Publication**

Daniels et al.

(10) **Pub. No.: US 2016/0013560 A1**

(43) **Pub. Date: Jan. 14, 2016**

(54) **ROBUST ANTENNA CONFIGURATIONS FOR WIRELESS CONNECTIVITY OF SMART HOME DEVICES**

(71) Applicant: **GOOGLE INC.**, Mountain View, CA (US)

(72) Inventors: **Eric Daniels**, San Francisco, CA (US); **Daniel Adam Warren**, San Francisco, CA (US); **Hirofumi Honjo**, Palo Alto, CA (US)

(73) Assignee: **GOOGLE INC.**, Mountain View, CA (US)

(21) Appl. No.: **14/328,476**

(22) Filed: **Jul. 10, 2014**

Publication Classification

(51) **Int. Cl.**

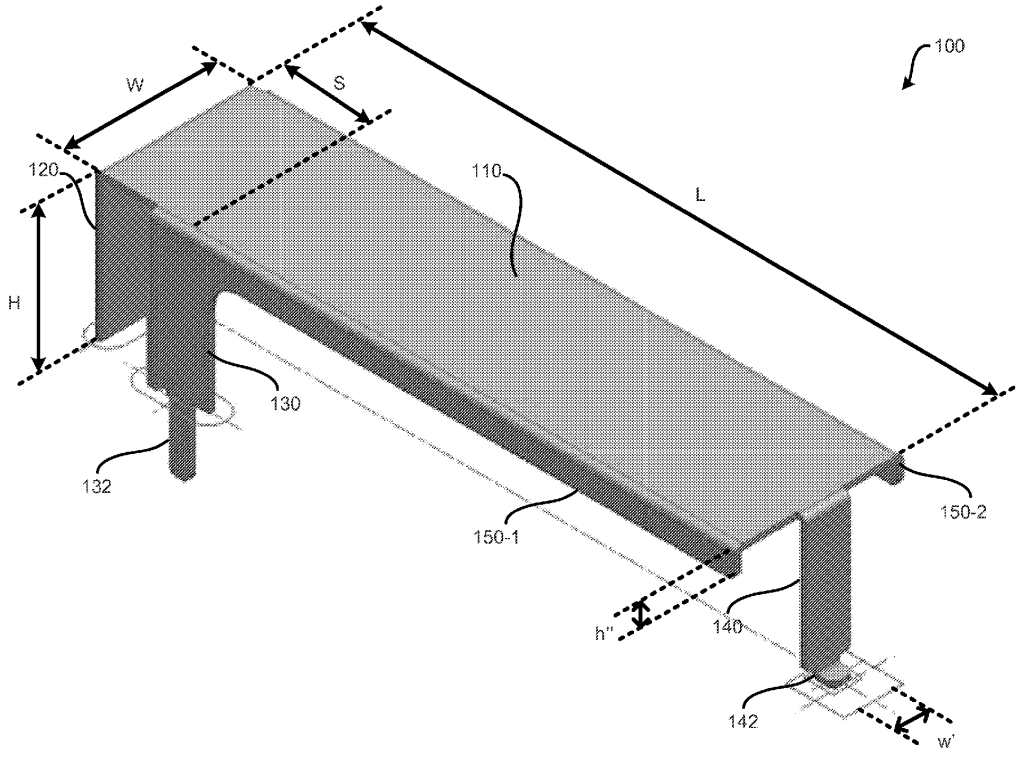
H01Q 9/42	(2006.01)
H01Q 1/24	(2006.01)
H01Q 1/50	(2006.01)

(52) **U.S. Cl.**

CPC . ***H01Q 9/42*** (2013.01); ***H01Q 1/50*** (2013.01); ***H01Q 1/24*** (2013.01)

(57) **ABSTRACT**

Various methods related to antennas and embodiments of antennas are presented. The antenna may include an upper arm, wherein the upper arm is substantially parallel to a ground plane and is electrically coupled with at least a ground shorting structure, a support structure, and a feed structure. The antenna may include the ground shorting structure, which may be at a first end of the upper arm. The antenna may include the support structure, which may be at a second end of the length of the upper arm and may support the upper arm. The antenna may also include the feed structure, which is configured to provide a signal for wireless transmission, the feed structure may be attached to a side of the length of the upper arm.



US 20160013561A1

(19) **United States**

(12) **Patent Application Publication**

Hong et al.

(10) **Pub. No.: US 2016/0013561 A1**

(43) **Pub. Date: Jan. 14, 2016**

(54) **ANTENNA MODULES HAVING FERRITE SUBSTRATES**

(71) Applicant: **THE BOARD OF TRUSTEES OF THE UNIVERSITY OF ALABAMA for and on behalf of THE UNIVERSITY OF ALABAMA**, Tuscaloosa, AL (US)

(72) Inventors: **Yang-Ki Hong**, Tuscaloosa, AL (US); **Jae-Jin Lee**, Tuscaloosa, AL (US)

(21) Appl. No.: **14/770,741**

(22) PCT Filed: **Feb. 25, 2014**

(86) PCT No.: **PCT/US14/18360**

§ 371 (c)(1),
(2) Date: **Aug. 26, 2015**

Related U.S. Application Data

(60) Provisional application No. 61/769,610, filed on Feb. 26, 2013.

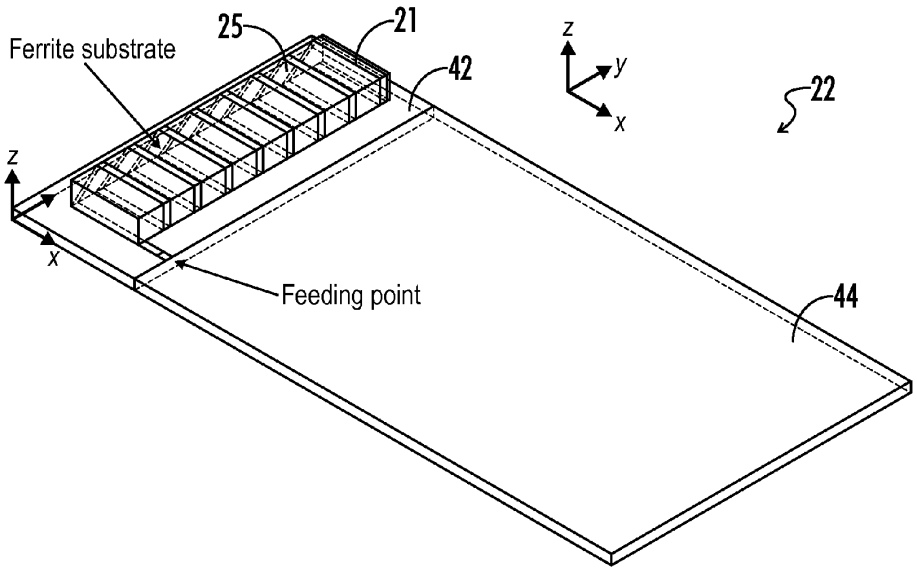
Publication Classification

(51) **Int. Cl.**
H01Q 17/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 17/004*** (2013.01)

(57) **ABSTRACT**

An antenna module (**22**) has an antenna (**21**) that is formed on a ferrite substrate (**31**), and the ferrite substrate is positioned within a small direct current (DC) magnetic field. The magnetic loss tangent of the ferrite is controlled by application of the small DC magnetic field, thereby improving antenna radiation efficiency and increasing the bandwidth of the antenna.



US 20160013563A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2016/0013563 A1**

(43) **Pub. Date: Jan. 14, 2016**

TIMOFEEV et al.

(54) **WIDEBAND TWIN BEAM ANTENNA ARRAY**

(71) Applicant: **Commscope Technologies, LLC**, Hickory, NC (US)

(72) Inventors: **Igor E. TIMOFEEV**, Dallas, TX (US); **Gangyi DENG**, Allen, TX (US)

(21) Appl. No.: **14/329,503**

(22) Filed: **Jul. 11, 2014**

Publication Classification

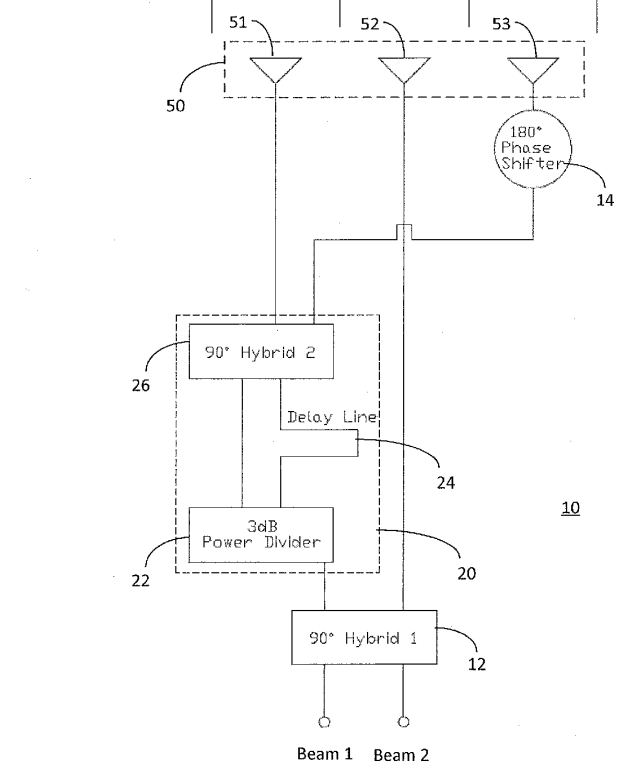
(51) **Int. Cl.**
H01Q 21/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H01Q 21/0075*** (2013.01)

(57) **ABSTRACT**

A wideband antenna includes a plurality of radiating elements arranged in an array and a feed network. The feed network includes at least one frequency dependent power divider for varying the amplitude of a signal provided to at least two of the plurality of radiating elements as a function of a frequency of a signal. The feed network may further comprise a plurality of inputs and the antenna may produce a plurality of beams. The frequency dependent divider may comprise a power divider having a first output and a second output, a 90° hybrid, having a first input coupled to the first output of the power divider, and a second input, and a delay line, coupled between the second output of the power divider and the second input of the 90° hybrid.

Frequency, GHz		1.7	2.2	2.7	1.7	2.2	2.7	1.7	2.2	2.7
Beam 1	Amplitude	0.7	0.36	0.14	1	1	1	0.7	0.88	0.98
	Phase, deg.	0	0	0	-90	-90	-90	180	180	180
Beam 2	Amplitude	0.7	0.36	0.14	1	1	1	0.7	0.88	0.98
	Phase, deg.	-90	-90	-90	0	0	0	90	90	90



US 20160013565A1

(19) **United States**

(12) **Patent Application Publication**

Ortiz

(10) **Pub. No.: US 2016/0013565 A1**

(43) **Pub. Date: Jan. 14, 2016**

(54) **MULTI-BAND ANTENNA ASSEMBLY**

(71) Applicant: **Mueller International, LLC**, Atlanta, GA (US)

(72) Inventor: **Jorge Isaac Ortiz**, Ocala, FL (US)

(21) Appl. No.: **14/331,196**

(22) Filed: **Jul. 14, 2014**

Publication Classification

(51) **Int. Cl.**

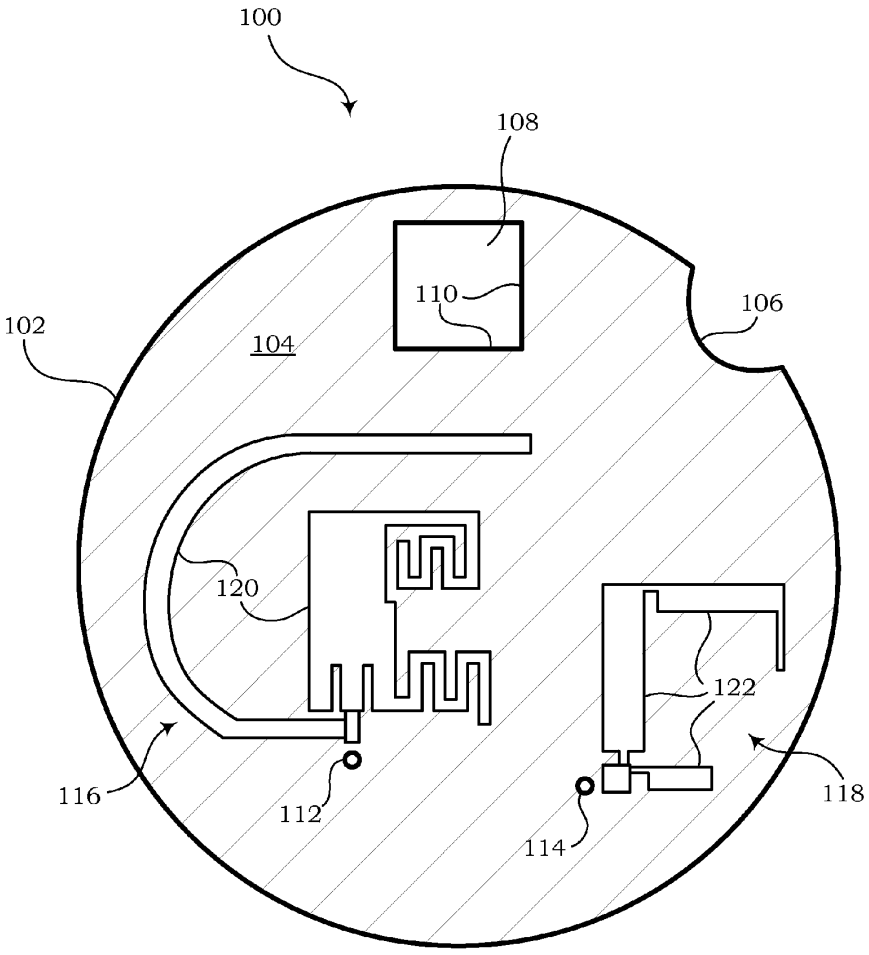
H01Q 21/30	(2006.01)
H05K 1/18	(2006.01)
H01Q 21/00	(2006.01)
H01Q 1/52	(2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 21/30*** (2013.01); ***H01Q 1/526*** (2013.01); ***H05K 1/18*** (2013.01); ***H01Q 21/0087*** (2013.01); *H05K 2201/10098* (2013.01); *H05K 2201/09027* (2013.01)

(57) **ABSTRACT**

Antenna assemblies and methods of manufacturing antenna assemblies are provided. In one embodiment, an antenna assembly comprises a printed circuit board having a first surface and a second surface. The antenna assembly also includes a cellular antenna structure having a first section disposed on the first surface of the printed circuit board and a second section disposed on the second surface of the printed circuit board. The antenna assembly further includes a wireless local area antenna structure having a first section disposed on the first surface of the printed circuit board and a second section disposed on the second surface of the printed circuit board.



US 20160013817A1

(19) **United States**

(12) **Patent Application Publication**

PARK et al.

(10) **Pub. No.: US 2016/0013817 A1**

(43) **Pub. Date: Jan. 14, 2016**

(54) **INTEGRATED ANTENNA AND SENSOR ELEMENT APPARATUS FOR A PORTABLE WIRELESS TERMINAL**

(71) Applicant: **Samsung Electronics Co., Ltd.**, Gyeonggi-do (KR)

(72) Inventors: **Gyu-Bok PARK**, Gyeonggi-do (KR); **Hee-Jun LEE**, Gyeonggi-do (KR); **Cheol-Hong SON**, Seoul (KR); **Austin KIM**, Gyeonggi-do (KR); **Joon-Ho BYUN**, Gyeonggi-do (KR); **Se-Hyun PARK**, Gyeonggi-do (KR); **Seong-Tae JEONG**, Gyeonggi-do (KR)

(21) Appl. No.: **14/864,160**

(22) Filed: **Sep. 24, 2015**

Related U.S. Application Data

(63) Continuation of application No. 13/441,992, filed on Apr. 9, 2012.

(30) **Foreign Application Priority Data**

Jul. 27, 2011 (KR) 10-2011-0074503

Publication Classification

(51) **Int. Cl.**

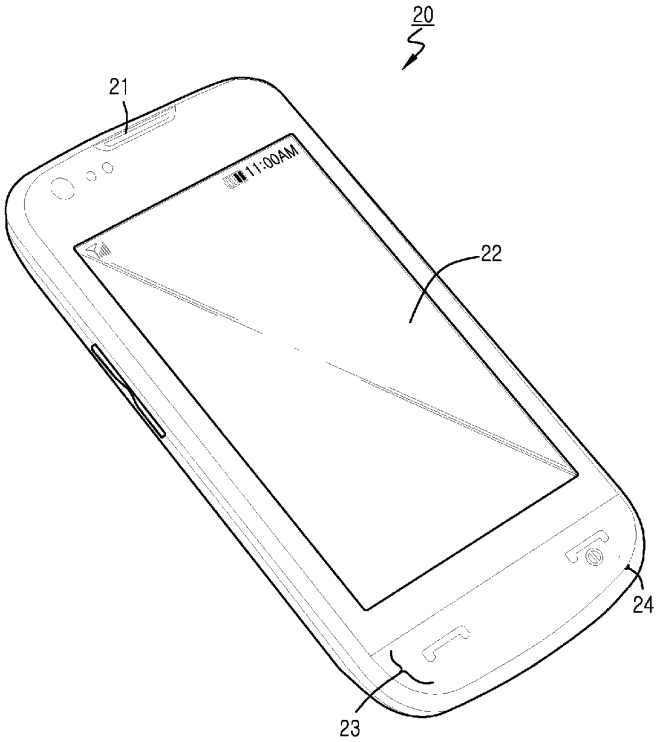
H04B 1/00	(2006.01)
H04W 52/24	(2006.01)
H04B 1/3827	(2006.01)
H04B 15/00	(2006.01)
H04W 52/28	(2006.01)

(52) **U.S. Cl.**

CPC ***H04B 1/0053*** (2013.01); ***H04B 15/00*** (2013.01); ***H04W 52/283*** (2013.01); ***H04B 1/3838*** (2013.01); ***H04W 52/243*** (2013.01); *H04W 88/06* (2013.01)

(57) **ABSTRACT**

An apparatus interworking with a metal member used both as an antenna and a sensor element in a portable terminal is disclosed. The apparatus includes the metal member, responsive to a sensed body, and for transmitting and receiving a signal in at least one or more communication service bands, and a main board having a communication module for processing a signal transmitted and received by the metal member and a sensor module for obtaining information in response to the approach of a sensed body.



US 20160020506A1

(19) **United States**

(12) **Patent Application Publication**

Mahanfar et al.

(10) **Pub. No.: US 2016/0020506 A1**

(43) **Pub. Date: Jan. 21, 2016**

(54) **ANTENNA FOR ELECTRONIC DEVICE**

(71) Applicant: **Microsoft Corporation**, Redmond, WA (US)

(72) Inventors: **Alireza Mahanfar**, Bellevue, WA (US); **Gregorio Tellez**, Redmond, WA (US); **Benjamin Shewan**, Redmond, WA (US); **Javier R. De Luis**, Kirkland, WA (US); **Gregory Kim Justice**, Redmond, WA (US); **Vinod L. Hingorani**, Redmond, WA (US)

(21) Appl. No.: **14/332,163**

(22) Filed: **Jul. 15, 2014**

Publication Classification

(51) **Int. Cl.**

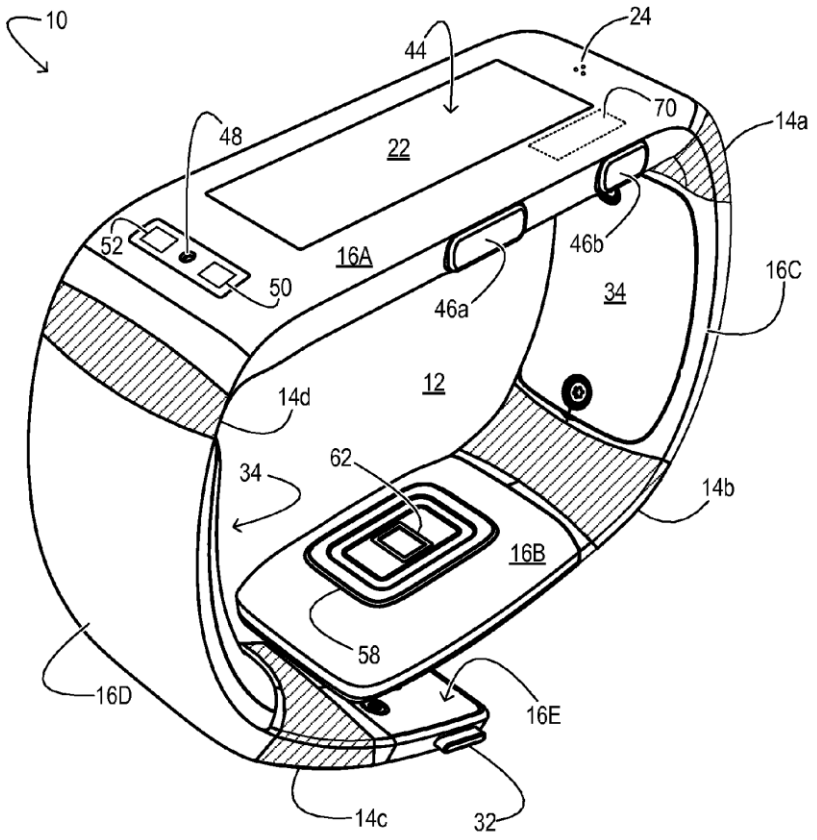
H01Q 1/27	(2006.01)
G04G 21/04	(2006.01)
H01Q 1/50	(2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 1/273*** (2013.01); ***H01Q 1/50*** (2013.01); ***G04G 21/04*** (2013.01)

(57) **ABSTRACT**

Embodiments are disclosed for an antenna system comprising an over-resonant antenna conductor and a radio receiver electrically coupled to the over-resonant antenna conductor. The antenna system further comprises a capacitor electrically coupled to the over-resonant antenna conductor and sized to match the antenna conductor to a selected frequency.



US 20160020513A1

(19) **United States**

(12) **Patent Application Publication**

OHGUCHI et al.

(10) **Pub. No.: US 2016/0020513 A1**

(43) **Pub. Date: Jan. 21, 2016**

(54) **ANTENNA ELEMENT AND ANTENNA DEVICE**

(71) Applicant: **SHARP KABUSHIKI KAISHA**, Osaka-shi, Osaka (JP)

(72) Inventors: **Shuhhei OHGUCHI**, Osaka-shi (JP); **Hiroyuki TAKEBE**, Osaka-shi (JP)

(73) Assignee: **SHARP KABUSHIKI KAISHA**, Osaka-shi, Osaka (JP)

(21) Appl. No.: **14/770,502**

(22) PCT Filed: **Jul. 1, 2014**

(86) PCT No.: **PCT/JP2014/067565**

§ 371 (c)(1),
(2) Date: **Aug. 26, 2015**

(30) **Foreign Application Priority Data**

Jul. 8, 2013 (JP) 2013-142717

Publication Classification

(51) **Int. Cl.**

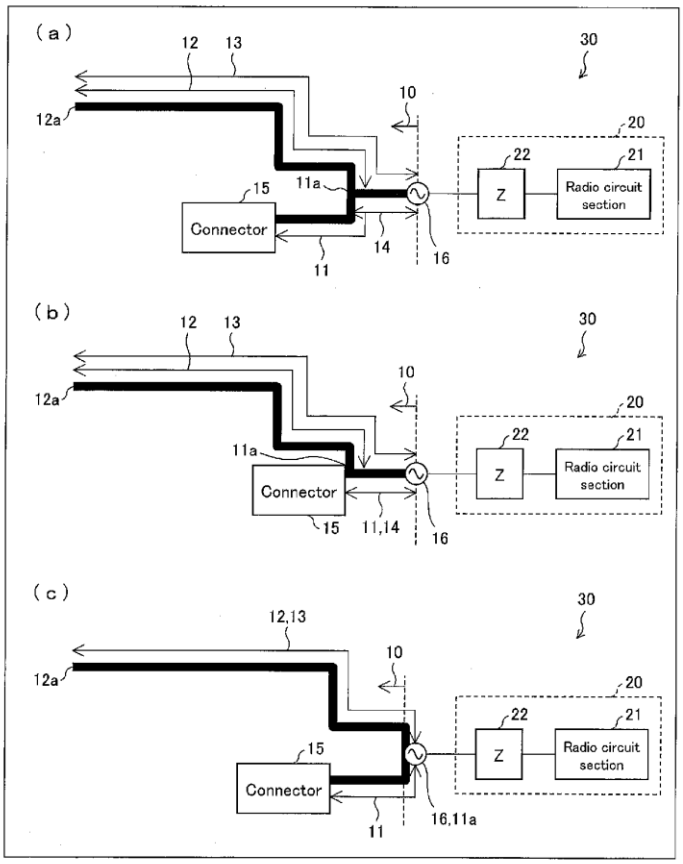
H01Q 1/50 (2006.01)
H01Q 1/27 (2006.01)
H01Q 1/36 (2006.01)

(52) **U.S. Cl.**

CPC . ***H01Q 1/50*** (2013.01); ***H01Q 1/36*** (2013.01); ***H01Q 1/273*** (2013.01)

(57) **ABSTRACT**

An antenna element (**10**) includes: a feeding point (**16**); a connector (**15**) in which an external antenna is detachably engaged; a first partial element (**11**) connecting the feeding point (**16**) and the connector (**15**); and a second partial element (**12**) branching from the first partial element (**11**) and having an open end (**12***a*) at a different position from the connector (**15**).



US 20160020527A1

(19) **United States**

(12) **Patent Application Publication**

KOGA et al.

(10) **Pub. No.: US 2016/0020527 A1**

(43) **Pub. Date: Jan. 21, 2016**

(54) **ANTENNA DEVICE**

(71) Applicant: **FUJITSU LIMITED**, Kawasaki-shi (JP)

(72) Inventors: **Yohei KOGA**, Kawasaki (JP); **Hiroyuki EGAWA**, Fukuoka (JP)

(21) Appl. No.: **14/739,679**

(22) Filed: **Jun. 15, 2015**

(30) **Foreign Application Priority Data**

Jul. 15, 2014 (JP) 2014-144999

Publication Classification

(51) **Int. Cl.**

H01Q 21/30 (2006.01)

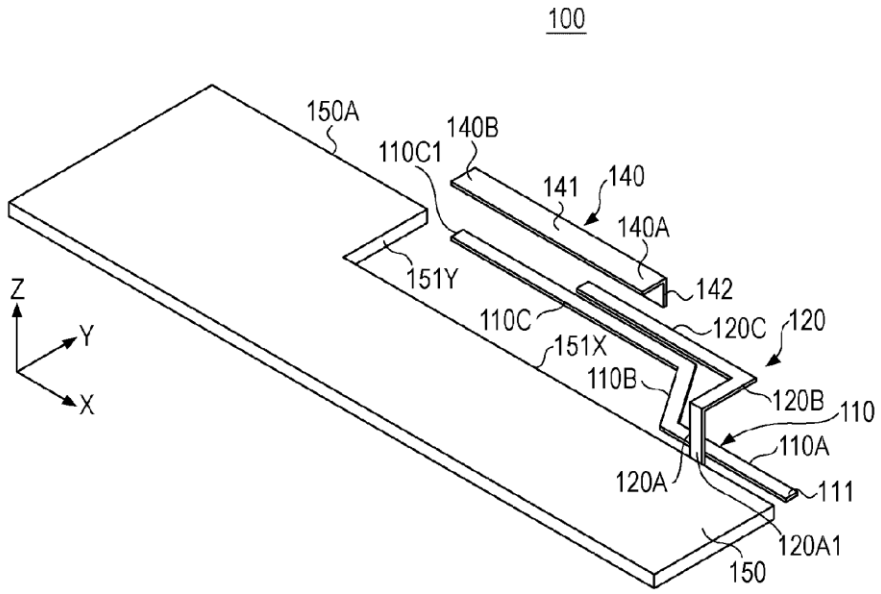
H01Q 9/16 (2006.01)

(52) **U.S. Cl.**

CPC . ***H01Q 21/30*** (2013.01); ***H01Q 9/16*** (2013.01)

(57) **ABSTRACT**

An antenna device includes a ground; a monopole antenna including a first section running from a feeding point along the ground, a second section running in a direction away from the ground, and a third section running along the ground, the monopole antenna having a length corresponding to ¼ of a wavelength at a first resonance frequency; a parasitic element including a first section whose end is connected to the ground in the vicinity of the end of the first section of the monopole antenna and that runs in a direction away from the ground, and a second section, the parasitic element having a length corresponding to ¼ of a wavelength at a second resonance frequency; and a dipole antenna provided along the third section of the monopole antenna and the parasitic element, the dipole antenna having a length corresponding to ½ of a wavelength at a third resonance frequency.



US 20160020647A1

(19) **United States**

(12) **Patent Application Publication**

Leabman et al.

(10) **Pub. No.: US 2016/0020647 A1**

(43) **Pub. Date: Jan. 21, 2016**

(54) **INTEGRATED ANTENNA STRUCTURE ARRAYS FOR WIRELESS POWER TRANSMISSION**

(71) Applicant: **ENERGOUS CORPORATION**, San Jose, CA (US)

(72) Inventors: **Michael A. Leabman**, San Ramon, CA (US); **Harry Contopanagos**, Kifissia (GR)

(73) Assignee: **ENERGOUS CORPORATION**, San Jose, CA (US)

(21) Appl. No.: **14/336,963**

(22) Filed: **Jul. 21, 2014**

Publication Classification

(51) **Int. Cl.**

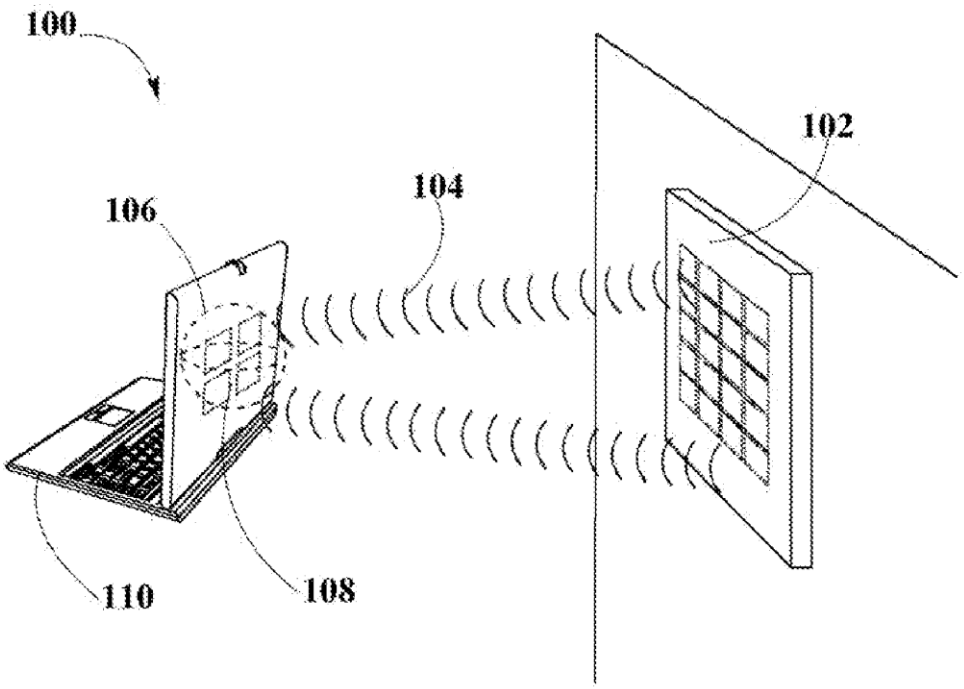
H02J 17/00	(2006.01)
H02J 5/00	(2006.01)
H01Q 21/06	(2006.01)

(52) **U.S. Cl.**

CPC ***H02J 17/00*** (2013.01); ***H01Q 21/061*** (2013.01); ***H02J 5/005*** (2013.01)

(57) **ABSTRACT**

A plurality of integrated antenna structures described herein may be formed in a flat panel antenna arrays which may be arranged in equally spaced grid and may be used in transmitters for sending focused RF waves towards a receiver for wireless power charging or powering. Each of the integrated antenna structures may include planar inverted-F antennas (PIFAs) integrated with artificial magnetic conductor (AMC) metamaterials. As a result of their high directionality and form factor, the integrated antenna structures may be placed very close together, thus enabling the integration of a high number of integrated antenna structures in a single flat panel antenna array which may fit about 400+ integrated antenna structures. Each integrated antenna structure in the flat panel antenna arrays may be operated independently, thus enabling an enhanced control over the pocket forming. In addition, the higher number of integrated antenna structures may contribute to a higher gain for the flat panel antenna arrays.



US 20160020814A1

(19) **United States**

(12) **Patent Application Publication**

Wang et al.

(10) **Pub. No.: US 2016/0020814 A1**

(43) **Pub. Date: Jan. 21, 2016**

(54) **METHOD FOR SIMPLIFIED CLOSED-LOOP ANTENNA TUNING**

(71) Applicant: **MEDIATEK Singapore Pte. Ltd.**, Singapore (SG)

(72) Inventors: **James June-Ming Wang**, San Marino, CA (US); **Qiang Zhou**, San Jose, CA (US); **YungPing Hsu**, Taipei City (TW); **Bernard Mark Tenbroek**, Kent (GB)

(21) Appl. No.: **14/799,413**

(22) Filed: **Jul. 14, 2015**

Related U.S. Application Data

(60) Provisional application No. 62/024,537, filed on Jul. 15, 2014.

Publication Classification

(51) **Int. Cl.**

H04B 1/40 (2006.01)

H01Q 5/335 (2006.01)

(52) **U.S. Cl.**

CPC . ***H04B 1/40*** (2013.01); ***H01Q 5/335*** (2015.01)

(57) **ABSTRACT**

A method of closed-loop antenna tuning (CLAT) search strategy based on maximum Relative Transducer Gain (RTG) is proposed. A search region that account for TX input mismatch and forward voltage gain is pre-computed. The search region that is independent of antenna load can be pre-computed to reduce the computation complexity. The Maximum RTG is searched by estimating antenna S-parameters corresponding to a good load match. The search is conducted between the peak forward voltage gain and the best load match. Global optimal with reasonable RTG can be found with limited number of iterations. The transmitter search region can further be constrained by the receiver path mismatching.